

## Section 955

**PRICE REDUCTION FORMULAS FOR  
NON SPECIFICATION LIQUID ASPHALT, ASPHALT CEMENT  
AND TIRE-RUBBER MODIFIED PG BINDERS**

**955.01 Scope**

Mathematical price reduction formulas are presented below for various liquid asphalts, asphalt cements, and tire-rubber modified pg binders not within strict compliance with specifications, but which may be accepted by the resident engineer at a reduced price.

**The following table illustrates various examples for calculating a price reduction:**

<b>Example</b>	<b>USING FORMULA</b>	<b>Specs</b>	<b>Acceptance limits</b>	<b>Sample Test Results</b>	<b>Calculated Difference</b>	<b>% Reduction Per Unit</b>	<b>Total % Reduction</b>
1	<b>53</b> (SS Emulsion Viscosity @ 77 °F, SFS)	20-100	17-115	16	1	5.75	5.75
2	<b>26</b> ( MC & SC-70 Viscosity @ 140 °F, cS)	70-140	68-144	55	13	0.62	8.06
3	<b>12</b> (AC-20 Viscosity @ 140°F, P)	1600-2400	1490-2570	2580	10	0.27	2.7
4	<b>10</b> (AC-10 Ductility @ 39.2 °F, cm)	15 min	12 min	9	3	8.0	24.0
5	<b>8</b> (AC-10 Viscosity @ 275°F, cSt)	250 min	228 min	200	28	0.44	12.32
6	<b>6</b> (AC-10 Viscosity @ 140 °F, P)	800-1200	740-1280	700	40	0.27	10.80

Since Reductions are cumulative, assuming examples 5 and 6 reductions were on the same sample, total reduction would be 12.32 % plus 10.80 % equals 23.12 %.

Price reductions will be assessed on the number of tons of liquid asphalt, asphalt cement, or tire-rubber modified pg binder represented by the sample. To determine the total price reduction, use the formula:

(Percent price reduction) X (Price per ton<sup>1</sup>) X Number of tons represented by the sample)

<sup>1</sup> Use the contract asphalt bid item or the contractor's invoice price per ton including freight to the mix site, which ever is the greater amount.

The following testing tolerances were used to calculate the testing acceptance limits listed in the price reduction formulas:

#### **ASPHALT CEMENT, POLYMER MODIFIED ASPHALT CEMENT TESTING TOLERANCES**

Viscosity @140 °F, P	7.0%
Viscosity @ 275 °F, cSt	8.8%
Penetration @ 77 °F, 0.1 mm	
Below 50	4 units
Above 50	8.0%
Penetration @ 39.2 °F, 0.1 mm	21.3%
Ductility @ 39.2 °F, cm	20.0%
Toughness @ 77 °F, in-lb	18.2%
Tenacity @ 77 °F, in-lb	20.0%
Softening Point, °F	3.4 %
Solubility, %	0.50 %
Viscosity @ 140 °F, P (RTFO Res)	7.0%
Ductility @ 39.2 °F, cm (RTFO Res)	20.0%
RTFO mass loss, %	16.0%
Softening Point, °F	3.4%

**EMULSIFIED REJUVENATION AGENT TESTING TOLERANCES:**

Saturates (ASTM D2007)	4.0%
Aromatics (ASTM D2207)	3.3%

**Examples****From formula 2, AC-5 Viscosity @ 140 °F, P**

<u>Specification</u>	<u>Tolerance</u>	<u>Acceptance Range</u>	<u>Test Results</u>	<u>Difference</u>	<u>%Reduction</u>
400-600	7.0%	370-640	642	+2	1.08

**From formula 10 AC-10 Ductility @ 39.2 °F, cm**

15 Min.	20%	12 Min.	11	-1	8.0
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**HOT-POUR CRACK AND JOINT SEALANT  
TESTING TOLERANCES**

Force Ductility, lbf	12.5 %
Rotational Viscosity, cP	10.0 %
Softening Point, °F	5.0 %
Flow, mm	16.7 %
Resilience, %	10 %
Cone Pen, 0.1 mm	10 %

**LIQUID ASPHALT TESTING TOLERANCES****Viscosity @ 140 °F:**

Below 3000, cSt	3.0%
3000-6000, cSt	9.0%
Above 6000, cSt	10.0%

**Distillation:**

To 347°F	3.5%
Above 347 °F	2.0%
Residue, Volume	2.0%

**Test on Residue:**

Viscosity @ 140 °F, P	3.0%
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**Examples****From formula 26 RC, SC & MC-70 Viscosity @ 140 °F, cSt**

<u>Specifications</u>	<u>Tolerance</u>	<u>Acceptance Range</u>	<u>Results</u>	<u>Difference</u>	<u>%Reduction</u>
70-140	3.0%	68-144	68	0	0.0

**From formula 22 MC-70 Residue Viscosity @ 140 °F, P**

300-1200	3.0%	290-1240	290	0	0.0
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**From formula 32 RC-3000 Viscosity @ 140 °F, cSt**

3000-6000	9.0%	2730-6540	2730	0	0.0
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**EMULSIFIED ASPHALT TESTING TOLERANCES****Viscosity, Saybolt**

20-100 @ 25 °C	SFS	15.0%
75-400 @ 50 °C	SFS	20.0%
>400 @ 60 °C	SFS	20.0%

**Tests on Residue from Distillation:**

Ductility @ 39.2 °F, 0.1 mm	20.0%
Toughness @ 77 °F, in-lb	8.2%
Tenacity @ 77 ° F, in-lb	20.0%
Penetration @ 77 °F, 0.1mm	8.0 %

**Examples****From formula 53 SS Emulsion @ 77 °F, SFS**

<u>Specifications</u>	<u>Tolerance</u>	<u>Acceptance Range</u>	<u>Results</u>	<u>Difference</u>	<u>%Reduction</u>
20-100	5.0%	17-115	16	1	5.75

**PRICE REDUCTION FORMULAS**

Note: X = actual reported test result

**Grade AC-5 Asphalt Cement**

Viscosity @ 140 °F, P

Specification Limits (400-600)

Testing Acceptance Limits (370-640)

Price Adjustment =  $0.54(370-X)$  for  $X < 370$

Formula 1

or  $0.54(X-640)$  for  $X > 640$

Formula 2

Viscosity @ 275 °F, cSt

Specification Limits ( at least 175 )

Testing Acceptance Limits > 160

Price Adjustment =  $0.54(160-X)$  for  $X < 160$

Formula 3

Penetration @ 77°F, 0.1 mm

Specification Limits ( at least 140 )

Testing Acceptance Limits > 129

Price Adjustment =  $0.72(129-X)$  for  $X < 129$

Formula 4

Ductility @ 39.2 °F, cm

Specification Limits ( at least 25 )

Testing Acceptance Limits > 20

Price Adjustment =  $4.8(20-X)$  for  $X < 20$

Formula 5

**Grade AC-10 Asphalt Cement**

Viscosity at 140°F, P

Specification Limits ( 800-1200)

Testing Acceptance Limits ( 740-1280)

Price Adjustment =  $0.27(740-X)$  for  $X < 740$

Formula 6

or  $0.27(X-1280)$  for  $X > 1280$

Formula 7

Viscosity at 275 °F, cSt

Specification Limits ( at least 250 )

Testing Acceptance Limits > 228

Price Adjustment =  $0.44(228-X)$  for  $X < 228$

Formula 8

Penetration at 77 °F, 0.1mm

Specification Limits ( at least 80 )

Testing Acceptance Limits > 74

Price Adjustment =  $1.1(74-X)$  for  $X < 74$

Formula 9

Ductility at 39.2 °F, cm  
 Specification Limits ( at least 15 )  
 Testing Acceptance Limits > 12  
 Price Adjustment =  $8.0(12 - X)$  for  $X < 12$  Formula 10

### Grade AC-20 Asphalt Cement

Viscosity at 140 °F, P  
 Specification Limits ( 1600-2400 )  
 Testing Acceptance Limits ( 1490-2570 )  
 Price Adjustment =  $0.27(1490 - X)$  for  $X < 1490$  Formula 11  
                           or  $0.27(X - 2570)$  for  $X > 2570$  Formula 12

Viscosity at 140 °F ( AC-20P), P  
 Specification Limits ( at least 180 )  
 Testing Acceptance Limits > 167  
 Price Adjustment =  $0.18(1670 - X)$  for  $X < 1670$  Formula 13

Viscosity at 275 °F, cSt  
 Specification Limits ( at least 300 )  
 Testing Acceptance Limits > 274  
 Price Adjustment =  $0.37(274 - X)$  for  $X < 274$  Formula 14

Penetration at 25 °C, 0.1mm  
 Specification Limits ( at least 60 )  
 Testing Acceptance Limits > 55  
 Price Adjustment =  $1.62(55 - X)$  for  $X < 55$  Formula 15

Ductility at 39.2 °F, cm  
 Specification Limits ( at least 5 )  
 Testing Acceptance Limits > 4  
 Price Adjustment =  $24.0(4 - X)$  for  $X < 4$  Formula 16

Ductility at 39.2 °F, (AC-20P), cm  
 Specification Limits ( at least 50 )  
 Testing Acceptance Limits > 40  
 Price Adjustment =  $4.8(40 - X)$  for  $X < 40$  Formula 17

Ductility at 4 °C after RTFO (AC-20P), cm  
 Specification Limits (at least 25 )  
 Testing Acceptance Limits > 20  
 Price Adjustment =  $4.8(20 - X)$  for  $X < 20$  Formula 18

Toughness (AC-20P), in-lb  
 Specification Limits ( at least 110 )  
 Testing Acceptance Limits >90  
 Price Adjustment =  $2.0(90-X)$  for  $X < 90$  Formula 19

Tenacity (AC-20P), in-lb  
 Specification Limits ( at least 75 )  
 Testing Acceptance Limits >60  
 Price Adjustment =  $2.66(60-X)$  for  $X < 60$  Formula 20

### **Tire Rubber Modified PG binders**

Solubility, %  
 Specification Limits (at least 98)  
 Testing Acceptance Limits (at least 97.5)  
 Price Adjustment =  $15.1(97.5-X)$  for  $X < 97.5$  Formula 21

### **Hot-Applied Crack and Joint Sealants**

Hot-Applied Crack Sealants are pre-tested by UDOT prior to use. Acceptance parameters are based on the above tabulated testing tolerances.

### **Cut-Back Liquid Asphalts**

Residue Viscosity @ 140 °F, MC, all grades, P  
 Specification Limits ( 300-1200 )  
 Testing Tolerance Limits ( 280-1280)  
 Price Adjustment =  $0.145(280-X)$  for  $X < 280$  Formula 22  
                           or  $0.145(X-1280)$  for  $X > 1280$  Formula 23

Residue Viscosity @ 140 °F RC, all grades, P  
 Specification Limits ( 600-2400 )  
 Testing Acceptance Limits ( 560-2570)  
 Price Adjustment =  $0.073(560-X)$  for  $X < 560$  Formula 24  
                           or  $0.073(X-2570)$  for  $X > 2570$  Formula 25

Viscosity @ 140 °F, MC-RC-SC 70, cSt  
 Specification Limits ( 70-140 )  
 Testing Acceptance Limits ( 68-144 )  
 Price Adjustment =  $0.62(68-X)$  for  $X < 68$  Formula 26  
                           or  $0.21(X-144)$  for  $X > 144$  Formula 27

Viscosity @ 140 °F, MC-RC-SC 250, cSt  
 Specification Limits ( 250-500 )  
 Testing Acceptance Limits ( 242-515 )  
 Price Adjustment =  $0.21(242-X)$  for  $X < 242$  Formula 28  
                           or  $0.082(X-515)$  for  $X > 515$  Formula 29

Viscosity @ 140 °F, MC-RC-SC 800, cSt Specification Limits ( 800-1600 ) Testing Acceptance Limits ( 776-1648 ) Price Adjustment = $0.21(776-X)$ for $X < 776$ or $0.082(X-1648)$ for $X > 1648$	Formula 30 Formula 31
Viscosity @ 140 °F, RC 3000, cSt Specification Limits ( 3000-6000 ) Testing Acceptance Limits ( 2730-6540 ) Price Adjustment = $0.21(2730-X)$ for $X < 2730$ or $0.082(X-6540)$ for $X > 6540$	Formula 32 Formula 33
RC-70 Distillation Fraction to 374 °F Specification Limits ( 10 minimum ) Testing Acceptance Limits $> 9.65$ Price Adjustment = $5.18(9.65-X)$ for $X < 9.65$	Formula 34
RC-70 Distillation Fraction to 437 °F Specification Limits ( 50 minimum ) Testing Acceptance Limits $> 49$ Price Adjustment = $5.1(49-X)$ for $X < 49$	Formula 35
RC-70 Distillation Fraction to 500 °F Specification Limits ( 70 minimum ) Testing Acceptance Limits $> 68.6$ Price Adjustment = $5.1(68.6-X)$ for $X < 68.6$	Formula 36
RC-70 Distillation Fraction to 600 °F Specification Limits ( 85 minimum ) Testing Acceptance Limits $> 83.3$ Price Adjustment = $5.1(83.3-X)$ for $X < 83.3$	Formula 37
MC-70 Distillation Fraction to 437 °F Specification Limits ( 0-20 ) Testing Acceptance Limits $< 20.4$ Price Adjustment = $5.1(X-20.4)$ for $X > 20.4$	Formula 38
MC-70 Distillation Fraction to 500 °F Specification Limits ( 20-60 ) Testing Acceptance Limits ( 19.6-61.2 ) Price Adjustment = $5.1(19.6-X)$ for $X < 19.6$ or $5.1(X-61.2)$ for $X > 61.2$	Formula 39 Formula 40
MC-70 Distillation Fraction to 600 °F Specification Limits ( 65-90 ) Testing Acceptance Limits ( 63.7-91.8 ) Price Adjustment = $5.1(63.7-X)$ for $X < 63.7$ or $5.1(X-91.8)$ for $X > 91.8$	Formula 41 Formula 42
MC-250 Distillation Fraction to 437 °F Specification Limits ( 0-10 ) Testing Acceptance Limits $< 10.2$ Price Adjustment = $5.1(X-10.2)$ for $X > 10.2$	Formula 43



MC-250 Distillation Fraction to 500 °F  
 Specification Limits ( 15-55 )  
 Testing Acceptance Limits ( 14.7-56.1 )  
 Price Adjustment =  $5.1 (14.7 - X)$  for  $X < 14.7$   
                           or  $5.1 (X - 56.1)$  for  $X > 56.1$

Formula 44  
 Formula 45

MC-250 Distillation Fraction to 600 °F  
 Specification Limits ( 60-87 )  
 Testing Acceptance Limits ( 58.8-88.7 )  
 Price Adjustment =  $5.1 (58.8 - X)$  for  $X < 58.8$   
                           or  $5.1 (X - 88.7)$  for  $X > 88.7$

Formula 46  
 Formula 47

MC-800 Distillation Fraction to 500 °F  
 Specification Limits ( 0-35 )  
 Testing Acceptance Limits  $< 35.7$   
 Price Adjustment =  $5.1 (X - 35.7)$  for  $X > 35.7$

Formula 48

MC-800 Distillation Fraction to 600 °F  
 Specification Limits ( 45-80 )  
 Testing Acceptance Limits ( 44.1-81.6 )  
 Price Adjustment =  $5.1 (44.1 - X)$  for  $X < 44.1$   
                           or  $5.1 (X - 81.6)$  for  $X > 81.6$

Formula 49  
 Formula 50

SC-800 Distillation Fraction to 680 °F  
 Specification Limits ( 2-12 )  
 Testing Acceptance Limits ( 1.96-12.24 )  
 Price Adjustment =  $5.1 (1.96 - X)$  for  $X < 1.96$   
                           or  $5.1 (X - 12.24)$  for  $X > 12.24$

Formula 51  
 Formula 52

### Emulsified Asphalt

SS1, SS1h, CSS-1, CSS-1h Emulsion Viscosity @ 77 °F, SFS  
 Specification Limits ( 20-100 )  
 Testing Acceptance Limits ( 17-115 )  
 Price Adjustment =  $5.75 (17 - X)$  for  $X < 17$   
                           or  $1.15 (X - 115)$  for  $X > 115$

Formula 53  
 Formula 54

Residue by Evaporation ( CSS-1, CSS-1h, SS-1, SS-1h )  
 Specification Limits ( 57 min )  
 Testing Acceptance Limits  $> 56.54$   
 Price Adjustment =  $5.1 (56.54 - X)$  for  $X < 56.54$

Formula 55

### Chip-Seal Emulsions

**CRS-2A,B Emulsion** Viscosity @ 122 °F, SFS  
 Specification Limits ( 140-400 )  
 No Testing Tolerances Allowed  
 Accepted or rejected at project site

**CRS-2P Emulsion** Viscosity @ 140 °F, SFS  
 Specification Limits (100-400)  
 No Testing Tolerances Allowed  
 Accepted or rejected at project site

**CRS-2P Emulsion , Residue from Distillation**

Penetration @ 77 °F, 0.1 mm

Specification Limits (80-150)

Testing Acceptance Limits (73-162)

Price Adjustment=  $1.08(73-X)$  for  $X < 73$ 

Formula 56

 $1.08(X-162)$  for  $X > 162$ 

Formula 57

Ductility @ 39.2 °F, cm, Residue from Distillation

Specification Limit (35 min)

Testing Acceptance Limits (28)

Price Adjustment=  $4.8(28-X)$  for  $X < 28$ 

Formula 58

Toughness, in-lb, Residue from Distillation

Specification Limit (75 min)

Testing Acceptance Limit (61 min)

Price Adjustment=  $1.97(61-X)$  for  $X < 61$ 

Formula 59

Tenacity, in-lb, Residue from Distillation

Specification Limit (50 min)

Testing Acceptance Limit (40 min)

Price Adjustment=  $2.66(40-X)$  for  $X < 40$ 

Formula 60

**LMCRS-2 Emulsion**, Viscosity @ 122 °F, SFS

Specification Limits (75-300)

No Testing Tolerances Allowed

Accepted or rejected at project site

**HFRS-2P Emulsion**, Viscosity @ 122 °F, SFS

Specification Limits (50-450)

No Testing Tolerances Allowed

Accepted or rejected at project site

**LMCRS-2, Residue from Distillation**

Penetration at 77 °F, 0.1mm

Specification Limits (40-200)

Testing Acceptance Limits (36-216)

Price Adjustment =  $2.16(36-X)$  for  $X < 36$ 

Formula 61

Price Adjustment =  $3.24(X-216)$  for  $X > 216$ 

Formula 62

Torsional Recovery, %, Residue from Distillation

Specification Limits (at least 18)

Testing Acceptance Limits (at least 18)

Price Adjustment =  $10(18-X)$  for  $X < 18$ 

Formula 63

**Residue by Evaporation** CRS-2, CRS-2A, CRS-2B , HFRS-2P Specification Limits ( 65 minimum )Testing Acceptance Limits  $> 64.48$ 

Accepted or Rejected at project site

Residue by Evaporation, CRS-2P , (68 minimum)

Testing Acceptance Limits  $> 67.46$ 

Accepted or Rejected at project site

**HFMS-2P, Residue from Distillation**

Penetration at 77 °F, 0.1mm, Residue from Distillation  
Specification Limits (70-300)

Testing Acceptance Limits (64-324)

Price Adjustment =  $1.08 (64 - X)$  for  $X \leq 64$

Formula 64

Price Adjustment =  $1.08 (X - 324)$  for  $X \geq 324$

Formula 65

Float Test, sec, Residue from Distillation

Specification Limits (at least 1200)

Testing Acceptance Limits (at least 840)

Price Adjustment =  $0.130 (840 - X)$  for  $X \leq 840$

Formula 66

Elastic Recovery, 77 °F, %, Residue from Distillation

Specification Limits (at least 50)

Testing Acceptance Limits = (at least 50)

Price Adjustment =  $2 (50 - X)$  for  $X \leq 50$

Formula 67

**HFRS-2P, Residue from Distillation**

Penetration at 77 °F, 0.1 mm, Residue from Distillation  
Specification Limits (70-150)

Testing Acceptance Limits (64-162)

Price Adjustment =  $1.08 (64 - X)$  for  $X \leq 64$

Formula 68

Price Adjustment =  $1.08 (X - 162)$  for  $X \geq 162$

Formula 69

Float Test, sec, Residue from Distillation

Specification Limits (at least 1200)

Testing Acceptance Limits (at least 840)

Price Adjustment =  $0.130 (840 - X)$  for  $X \leq 840$

Formula 70

Elastic Recovery, 77 °F, %, Residue from Distillation

Specification Limits (at least 58)

Testing Acceptance Limits (at least 58)

Price Adjustment =  $2 (58 - X)$  for  $X \leq 58$

Formula 71